Commercial Requirements for the 2009 IECC and 90.1-2007

Workshop 2

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Introductions

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Code officials

Name

Municipality

Status of Commercial Codes

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Overview

Project funded by the Missouri Department of Natural Resources (MDNR) with American Recovery and Reinvestment Act of 2009 (ARRA) funding.

2 Locations:

- St. Louis
- Springfield

Objective of the Workshop: Work with municipalities and counties across the state to identify opportunities to adopt or enhance compliance with the 2009 International Energy Conservation Code (IECC) at a local level.

Overview

The "Local Energy Code Action Kit" developed by the Building Codes Assistance Project (BCAP) with ARRA funding provides municipalities and counties in Missouri with information and resources to support the adoption of the model energy code 2009 IECC.

A copy of the report is included with your materials.

The Building Energy Codes Program (BECP) works with the ICC, ASHRAE, IESNA, American Institute of Architects (AIA), the building industry, and state and local officials to develop and promote more stringent and easy-to-understand building energy codes and to assess potential code barriers to new energy-efficient technologies.

What are the topics for today?

1. Highlights of the Commercial portion of the 2009 IECC and of ASHRAE 90.1-2007
2. Overview of the requirements of Commercial envelope, mechanical and lighting provisions of the 2009 IECC
3. Process

Agenda

Topic	Approx. Time
Introduction, Project Background, Workshop Overview	15 minutes
2009 IECC and 90.1 2007-Highlights	15 minutes
Overview of the commercial mechanical requirements	30 minutes
Break	10 minutes
Overview of the commercial lighting requirements	30 minutes
Commercial Resources - building data collection checklist and COM*check*	30 minutes
Summary/Questions	10 minutes
Total Time	2 Hr 20 Min

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Some Important Points

Overall

- Focused on commercial
- Discussion-based
- Forum for ideas and practices

What can you expect?

- Code citations in [ ]
- Printed slides

Before we get started…

- Cell phones

Topic 1

Highlights of the Commercial portion of the 2009 IECC and of ASHRAE 90.1 2007

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Comparison of 2009 IECC and ASHRAE 90.1-2007

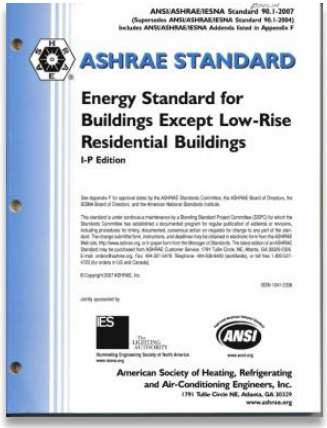
2009 IECC

- 2009 IECC developed by the *International Code Council (ICC)*
- New version every three years with more stringent requirements

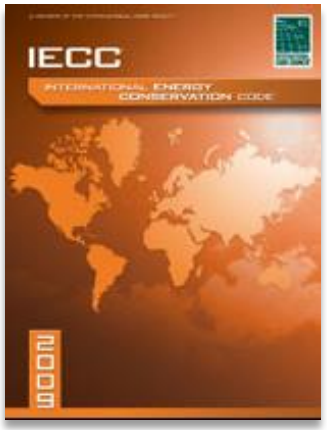
ASHRAE

- ASHRAE 90.1-2007 developed by *American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)*
- ASHRAE 90.1 is the referenced standard in IECC
- Compliance with ASHRAE 90.1-2007 results in 4% more energy savings than ASHRAE 90.1-2004

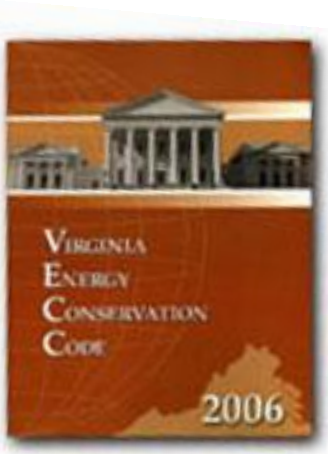
Building Energy Codes



ASHRAE Standard 90.1



International Energy Conservation Code



State and Locally Adopted Codes

Model Codes & Standards

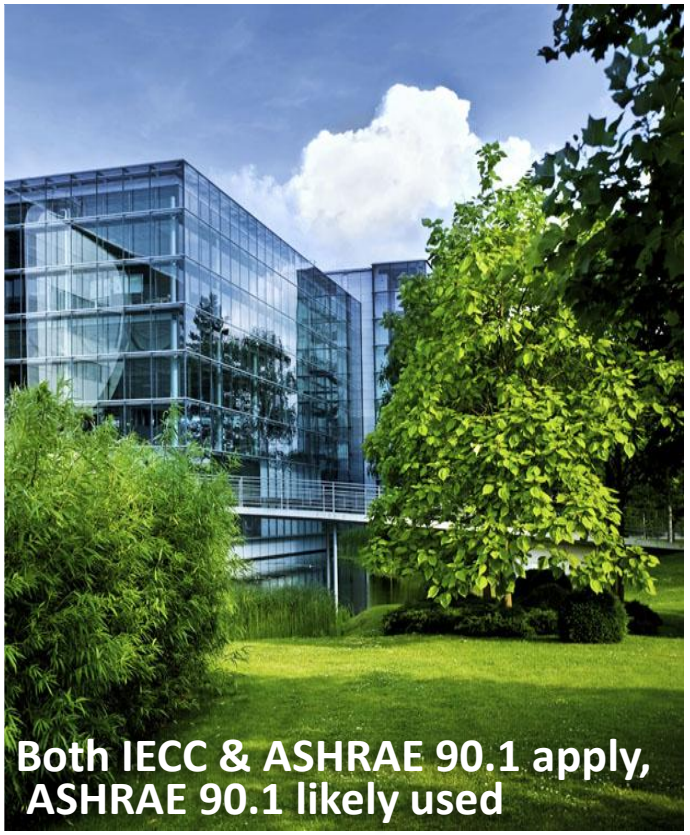
Title	Type	Applicability	Common Versions
International Energy Conservation Code (IECC)	Model Energy Code	Residential & commercial buildings; mandatory, enforceable language	2003 IECC 2006 IECC 2009 IECC
ASHRAE Standard 90.1 Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings	Energy Standard	All buildings except residential 3 stories or less	90.1-2004 90.1-2007

Commercial Provisions Contained in Chapter 5

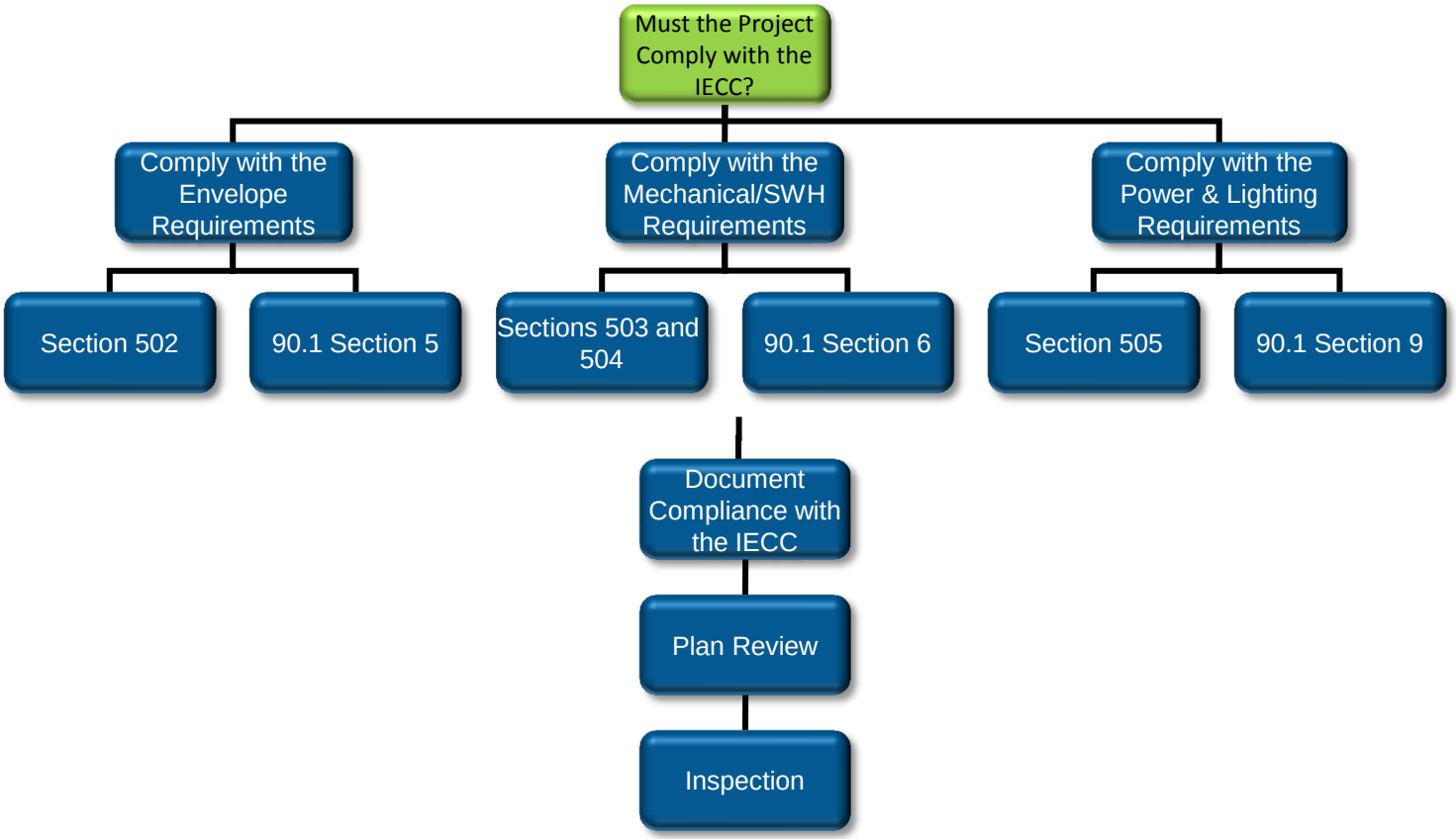
- IECC
- ASHRAE 90.1-2007

Section 501.2 “Application” requires 90.1 to be used in its entirety (Envelope, Lighting, Mechanical) if used as an alternate compliance path

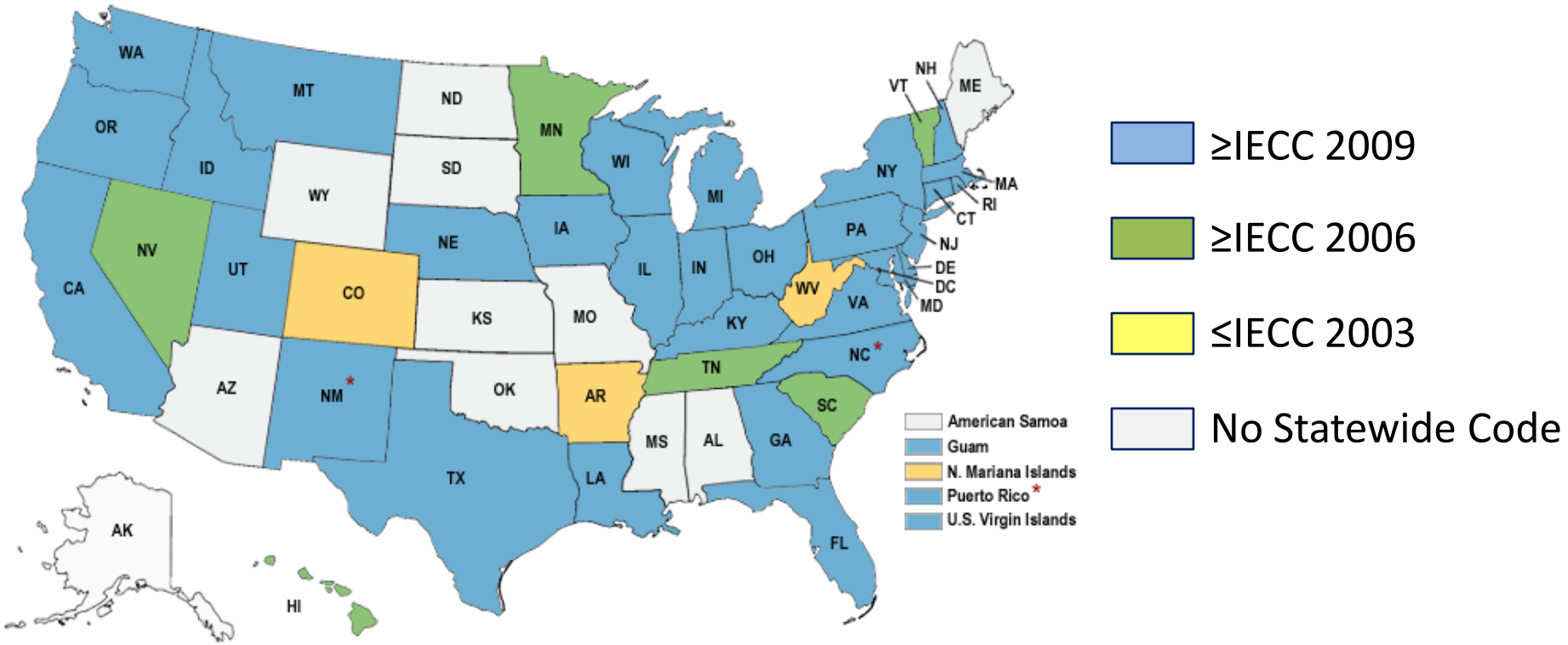
IECC or ASHRAE 90.1



2009 IECC Compliance



Commercial State Energy Code Status (*)



(*) as of November 1, 2011, DOE – Building Energy Codes Program

Topic 2

Overview of the requirements of Commercial envelope, lighting and **mechanical** provisions of the 2009 IECC

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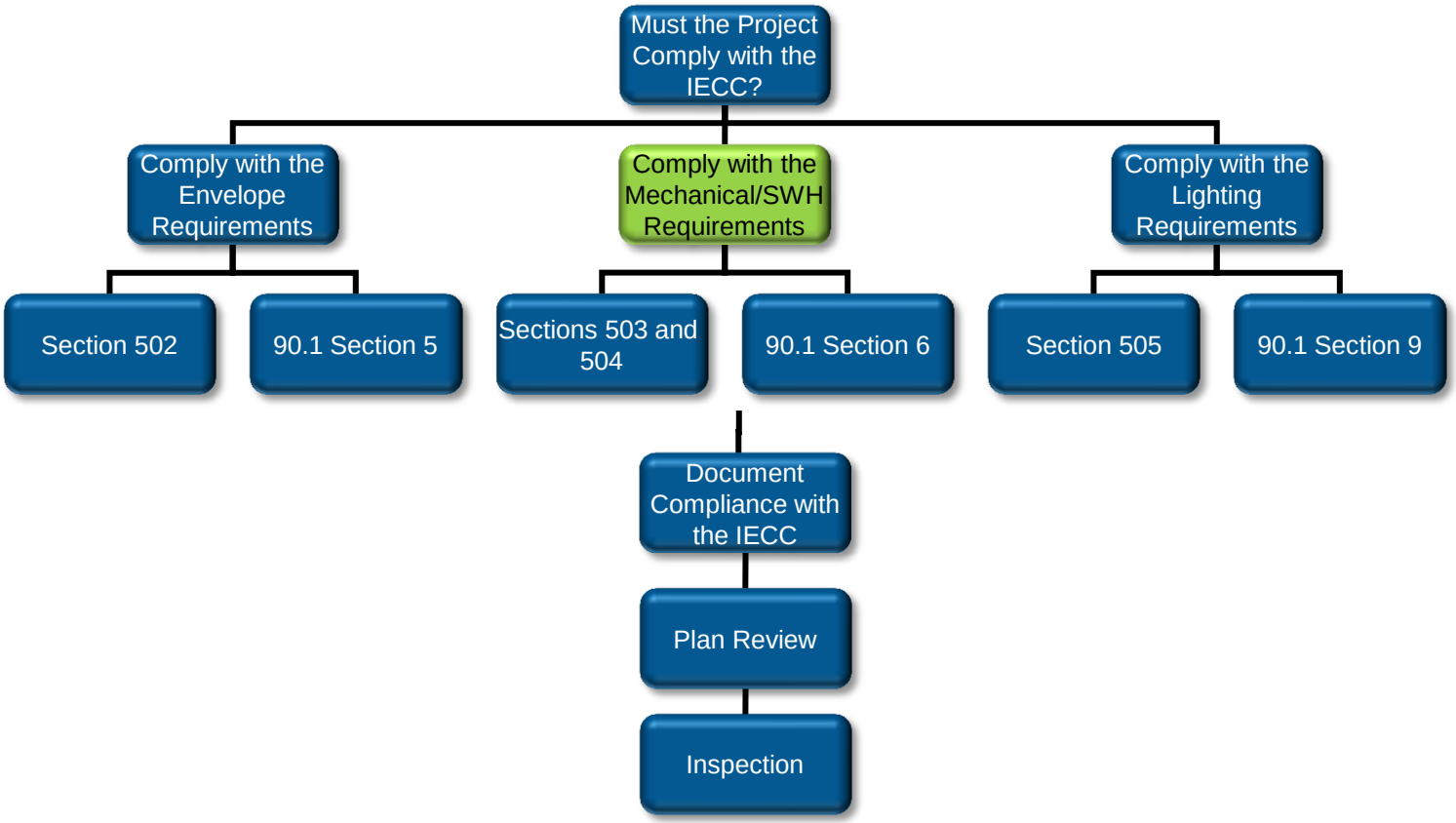
Introduction to the Energy Code Compliance Process



Section 503 Building Mechanical Systems

Simplified to Include Only Four Sections:

- What Provisions of the Code Apply (503.1)
- Mandatory Provisions (503.2)
- Simple HVAC Systems and Equipment (503.3)
- Complex HVAC Systems and Equipment (503.4)

What Provision of the Code Apply? (503.1)

Mandatory Provisions – Section 503.2 PLUS

- Section 503.3 (Simple Systems) or
- Section 503.4 (Complex Systems)

Simple Versus Complex Systems

- Simple systems
- Unitary or packaged HVAC equipment
- Serves one zone and controlled by a single thermostat

Section 503.3 Simple Systems

Buildings served by unitary or packaged HVAC each serving 1 zone controlled by 1 thermostat.

Two-pipe heating systems serving multiple zones are included if no cooling system is installed [Tables 503.2.3(1) through 503.2.3(5)]

Simple Versus Complex Systems

- Complex systems
- All equipment not covered under Section 503.3 Simple Systems

Section 503.4 Complex Systems

All buildings served by HVAC systems not covered under 503.3

Mandatory Provisions Applicable to ALL Mechanical Systems (503.2)

- HVAC Load Calculations
- Equipment and System Sizing
- HVAC Equipment Performance Requirements
- HVAC System Controls
- Ventilation

HVAC Load Calculations (503.2.1)

Heating and cooling load sizing calculations required

- ASHRAE/ACCA Standard 183
- Other approved computation procedures – defined in Chapter 3
  - Exterior design conditions
    - » Specified by ASHRAE
  - Interior design conditions
    - » Specified by Section 302 of the IECC
    - » ≤ 72°F for heating load
    - » ≥ 75°F for cooling load

Equipment and System Sizing (503.2.2)

- Output capacity SHALL NOT exceed sizing –
- Select the system which serves the greater load, heating or cooling

HVAC Performance (Minimum Efficiency) Requirements (503.2.3)

- Applies to all equipment used in heating and cooling of buildings
- Must comply with all listed efficiencies

Table 503.2.3(2)

TABLE 503.2.3(2)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
Air cooled, (Cooling mode)	< 65,000 Btu/h[d]	Split system	13.0 SEER	AHRI 210/240
		Single package	13.0 SEER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	10.1 EER[c] (before Jan 1, 2010) 11.0 EER[c] (as of Jan 1, 2010)	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	9.3 EER[c] (before Jan 1, 2010) 10.6 EER[c] (as of Jan 1, 2010)	AHRI 340/360
	≥ 240,000 Btu/h	Split system and single package	9.0 EER[c] 9.2 IPLV[c] (before Jan 1, 2010) 9.5 EER[c] 9.2 IPLV[c] (as of Jan 1, 2010)	
Through-the-Wall (Air cooled, cooling mode)	< 30,000 Btu/h[d]	Split system	10.9 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	AHRI 210/240
		Single package	10.6 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	
Water Source (Cooling mode)	< 17,000 Btu/h	86°F entering water	11.2 EER	AHRI/ASHRAE 13256-1
	≥ 17,000 Btu/h and < 135,000 Btu/h	86°F entering water	12.0 EER	AHRIASHRAE 13256-1
Groundwater Source (Cooling mode)	< 135,000 Btu/h	59°F entering water	16.2 EER	AHRI/ASHRAE 13256-1
Ground source (Cooling mode)	< 135,000 Btu/h	77°F entering water	13.4 EER	AHRI/ASHRAE 13256-1
Air cooled (Heating mode)	< 65,000 Btu/h[d] (Cooling capacity)	Split system	7.7 HSPF	AHRI 210/240
		Single package	7.7 HSPF	
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb Outdoor air	3.2 COP (before Jan 1, 2010) 3.3 COP (as of Jan 1, 2010)	
	≥ 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb Outdoor air	3.1 COP (before Jan 1, 2010) 3.2 COP (as of Jan 1, 2010)	AHRI 340/360

(continued)

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Table 503.2.3(3)

TABLE 503.2.3(3)
PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
PTAC (Cooling mode) New construction	All capacities	95°F db outdoor air	12.5 - (0.213 · Cap/1000) EER	ARI 310/380
PTAC (Cooling mode) Replacements[c]	All capacities	95°F db outdoor air	10.9 - (0.213 · Cap/1000) EER	
PTHP (Cooling mode) New construction	All capacities	95°F db outdoor air	12.3 - (0.213 · Cap/1000) EER	
PTHP (Cooling mode) Replacements[c]	All capacities	95°F db outdoor air	10.8 - (0.213 · Cap/1000) EER	
PTHP (Heating mode) New construction	All capacities	—	3.2 - (0.026 · Cap/1000) COP	
PTHP (Heating mode) Replacements[c]	All capacities	—	2.9 - (0.026 · Cap/1000) COP	

For SI: °C - [(°F) - 32] / 1.8, 1 British thermal unit per hour - 0.2931 W
db = dry-bulb temperature, °F
wb = wet-bulb temperature, °F

a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

c. Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY: NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406 mm) high and less than 42 inches (1067 mm) wide.

System Controls (503.2.4)

One temperature and humidity (when applicable) controller per zone

System Controls

Heat pump systems

Heat pump thermostat required

Demand Controlled Ventilation (503.2.5.1)

DCV must be provided for each zone with spaces > 500 ft² and the average occupant load > 40 people/1000 ft² of floor area where the HVAC system has:

- An air-side economizer,
- Automatic modulating control of the outdoor air damper,
- A design outdoor airflow > 3,000 cfm

Demand Controlled Ventilation (503.2.5.1) - Exceptions

- Systems with energy recovery per 503.2.6
- Multiple zone systems without direct digital control of single zones communicating with central control panel
- Systems with design outdoor airflow < 1,200 cfm
- Spaces where supply airflow rate minus any makeup or outgoing transfer air requirement < 1,200 cfm

Energy Recovery Ventilation Systems (503.2.6)

- Applies to individual fan systems with Design supply air capacity ≥ 5,000 cfm
- Minimum outside air supply of ≥ 70% of design supply air quantity
- Exhaust air recovery efficiency must be ≥ 50%

Duct and Plenum Insulation and Sealing (503.2.7)

Required for supply and return ducts and plenums

- Insulating ducts and plenums:
  - Located in unconditioned space - R5
  - Located outside the building - R8

Piping Insulation (503.2.8)

All piping serving heating or cooling system must be insulated in accordance with Table 503.2.8

Minimum Pipe Insulation

FLUID	NOMINAL PIPE DIAMETER (thickness in inches)	
	≤ 1.5”	≥ 1.5”
Steam	1 ½	3
Hot water	1 ½	2
Chilled water, brine or refrigerant	1 ½	1 ½

Exceptions to Table 503.2.8

- Internal piping, factory installed and tested
- Factory installed within room fan-coils and unit ventilators
- Tested and rated to AHRI 440 (except sampling and variation provisions in Section 6.5) and 840
- Piping for fluid in temperature range

HVAC System

Completion (503.2.9)

- Air System Balancing
- Hydronic System Balancing
- Equipment Capacity and Required Maintenance

Design and Control (503.2.10)

- HVAC systems with total fan system power > 5 hp to meet 503.2.10.1 and 503.2.10.2
- Allowable Fan Floor Horsepower
- Motor Nameplate Horsepower

Motor Nameplate Horsepower

- Selected fan motor to be no larger than first available motor size greater than bhp
- Fan bhp on design documents

Exceptions:

- Fans < 6 bhp, where first available motor larger than bhp has nameplate rating within 50% of bhp, next larger nameplate motor size may be selected
- Fans ≥ 6 bhp, where first available motor larger than bhp has nameplate rating within 30% of bhp, next larger nameplate motor size may be selected

*bhp = brake horsepower

Heating Outside a Building (503.2.11)

- To be radiant systems
- Controlled by an occupancy sensing device or timer switch
- So system is automatically de-energized when no occupants are present

Simple HVAC Systems and Equipment (503.3)

Unitary or packaged, single zone controlled by a single thermostat in the zone served. Includes:

Simple Systems

- Unitary packaged cooling system
- Split system cooling
- Packaged terminal A/C
- Heat pump cooling
- Unitary packaged heating
- Split system heating
- Packaged terminal heat pump
- Fuel-fired furnace
- Electrical resistance heating
- Two-pipe heating systems w/o cooling
- Economizers

Economizers (503.3.1)

Table 503.3.1(1)

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B, 2A, 7, 8	No requirement
2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B	Economizers on cooling systems ≥ 54,000 Btu/h[a]

[a] The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per building, or 20 percent of its air economizer capacity, whichever is greater

Economizers (503.3.1)

Trade-off high cooling efficiency for economizer

Table 503.3.1(2)

CLIMATE ZONES	COOLING EQUIPMENT PERFORMANCE IMPROVEMENT (EER OR IPLV)
2B	10% Efficiency Improvement
3B	15% Efficiency Improvement
4B	20% Efficiency Improvement

Complex HVAC Systems and Equipment (503.4)

Complex Systems

- Packaged VAV reheat
- Built-up VAV reheat
- Built-up single-fan, dual-duct VAV
- Built-up or packaged dual-fan, dual-duct VAV
- Four-pipe fan coil system with central plant
- Hydronic heat pump with central plant
- Any other multiple-zone system
- Hydronic space heating system
- Economizers

This section applies to all HVAC equipment and systems not included in Section 503.3

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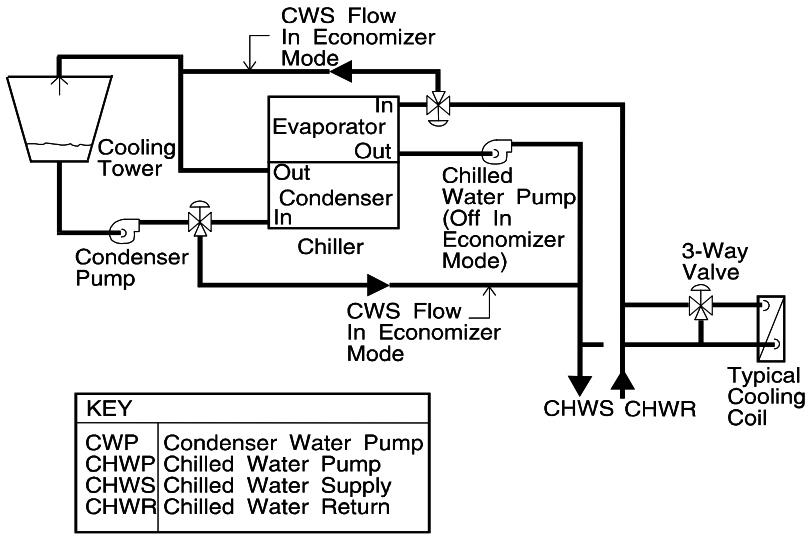
Economizers (503.4.1)

Air side economizer requirements and equipment performance exceptions in Tables *503.3.1(1) and 503.3.1(2)*

Water side economizer requirements

Capable of providing 100% of the cooling system load at 50° F dry bulb/ 45°F wet bulb



Variable Air Volume Fan Control (503.4.2)

Individual fans with motors ≥ 10hp

- Driven by a mechanical or electrical variable speed drive

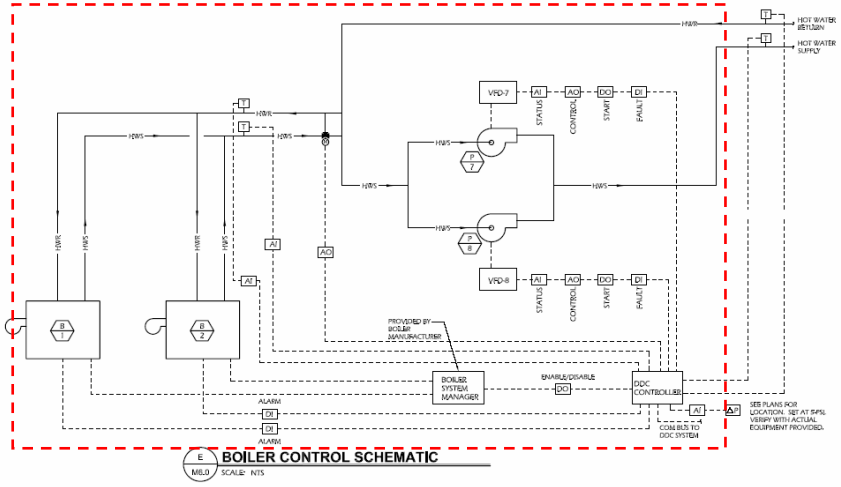
OR

- Have controls or devices to result in fan motor demand ≤ 30% of their design wattage at 50% of design airflow when static pressure set point = 1/3 of the total design static pressure

Hydronic System Controls (503.4.3)

Limit reheat/recool of fluids

- Multiple-packaged boiler systems designed to deliver conditioned water/steam into common distribution system
- Automatic controls capable of sequencing operation of the boilers



Hydronic System Controls (503.4.3)

Limit reheat/recool of fluids

- Single boilers > 500,000 Btu/h input design capacity
- Multi-staged or modulating burner required

Hydronic Systems (503.4.3)

- 3-Pipe System
- Can’t use a common return
- 2-Pipe Changeover System
- Dead band between changeover ≥ 15ºF outside temperature

Hydronic Water Loop Heat Pump Systems (503.4.3.3)

Temperature dead band of at least 20ºF *(503.4.3.3.1)*

- Exception: where system loop temp optimization controller is installed and can determine the most efficient operating temp based on realtime conditions of demand and capacity
- Heat rejection equipment in Climate Zones 3 and 4 *(503.4.3.3.2)*

Hydronic Water Loop Heat Pump Systems (503.4.3.3) – cont'd

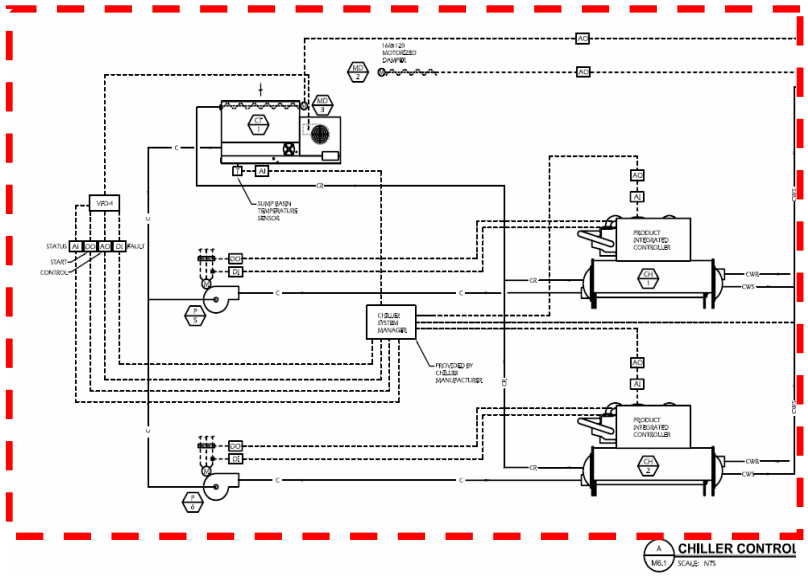
- Heat rejection equipment in Climate Zones 5 - 8
- Open- or closed-circuit cooling tower used
- Must have a separate heat exchanger to isolate cooling tower from heat pump loop
- Heat loss controlled by shutting down circulation pump on cooling tower loop and providing an automatic valve to stop flow of fluid
- Two position valve *(503.4.3.3.3)*
- Required on each hydronic heat pump with total pump system power > 10 hp

Part Load Control (503.4.3.4)

- System ≥ 300,000 Btu/h
- Automatic Resets for Supply Water Temperature by 25% of Design Supply-to-Return Temperature Differences **or**
- Reduce System Pump Flow by 50% of Design Flow Using
- Multiple Staged Pumps
- Adjustable Speed Drives
- Control Valves with Modulate or Step Down Capabilities

Pump Isolation (503.4.3.5)

- Multiple chiller chilled water plants
- Capability to reduce flow automatically when chiller is shut down
- Chillers piped in series considered one chiller



Heat Rejection Equipment Fan Speed Control (503.4.4)

Each fan powered by a motor ≥ 7.5 hp to have capability to operate that fan at 2/3 of full speed or less

- Have controls to automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device

Exception

- Factory-installed heat rejection devices within HVAC equipment tested and rated in accordance with Tables 503.2.3(6) and 503.2.3(7)

Multiple Zone System Requirements (503.4.5)

- VAV Systems must be designed and capable of being controlled to reduce the primary air supply to each zone before reheat, recool, or mixing take place
- Options
  - 30% of the maximum supply air to each zone
  - <300 cfm where the maximum flow rate is <10% of total fan system supply airflow rate
  - Minimum ventilation requirements from Chapter 4 of the IMC

Variable Air Volume System or Zone Exceptions

- Zones with special pressurization or cross-contamination requirements
- Where 75% of reheat energy comes from site-recovered or site-solar energy source
- Zones with special humidity requirements
- Zones with ≤ 300 cfm peak supply and flow rate is < 10% of total fan system supply airflow rate

Single Duct VAV Systems, Terminal Devices (503.4.5.1)

Single duct VAV systems to use terminal devices capable of reducing the supply of primary supply air before reheating or recooling takes place

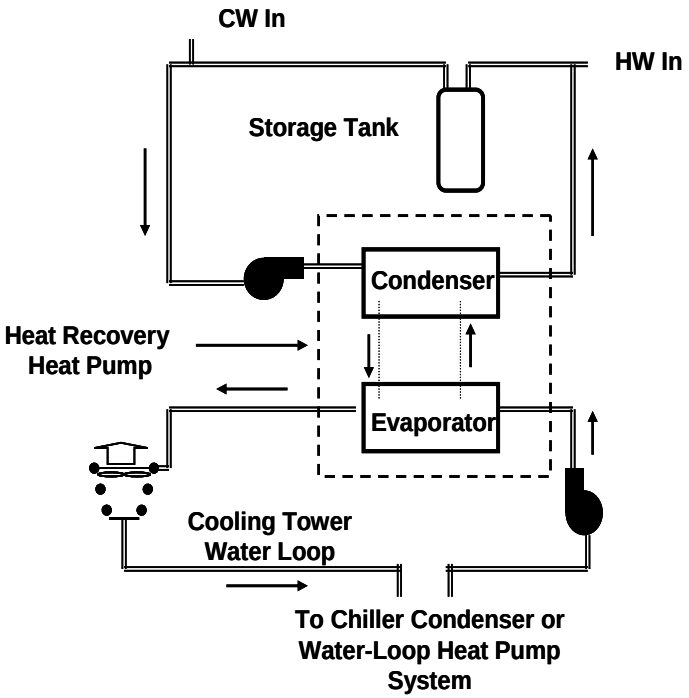
Supply-Air Temperature Reset Controls (503.4.5.4)

- Multiple zone HVAC systems to have controls to automatically reset supply-air temperature in response to building loads or outdoor air temperature
- Controls to be capable of resetting supply air temperature at least 25% of difference between design supply-air temperature and design room air temperature

Heat Recovery for Service Hot Water Heating (503.4.6)

Most effective where water heater loads are large and well distributed throughout the day

- Typical applications: hotels, dorms, prisons, hospitals
- Condenser heat recovery required for heating/reheating of SWH provided:
- Facility operates 24 hours/day



Section 504 Service Water Heating

- Service water-heating equipment performance efficiency *(504.2)*
- Table 504.2 Minimum Performance of Water-Heating Equipment
- Water Heater Types Covered
- Electric Storage
- Gas and Oil Storage
- Instantaneous Water Heaters – Gas and Oil

Pipe Insulation (504.5)

Noncirculating system insulation requirements

- First eight feet of outlet piping on systems with no integral heat traps
- 1/2 inch of insulation required

Circulating systems

- 1 inch of insulation

Hot Water System Controls (504.6)

- Ability to turn off circulating hot water pumps and heat trace tape when the system is not in operation
- Automatically or manually

Pool Requirements (504.7)

Pool heaters *(504.7.1)*

- Readily accessible on-off switch
- Natural gas or LPG fired pool heaters will not have continuously burning pilot lights

Time switches *(504.7.2)*

- Automatic controls required to operate pool heaters and pumps on a preset schedule

Pool Covers (504.7.3)

- Heated pools required to have a pool cover
- Pool cover must be vapor retardant
- Pools heated to over 90^{o}F
  - Minimum R-12 insulation

Break

10 minutes

We’re going to start topic 2 again at ____

Topic 3

Overview of the requirements of Commercial envelope, **lighting** and mechanical provisions of the 2009 IECC

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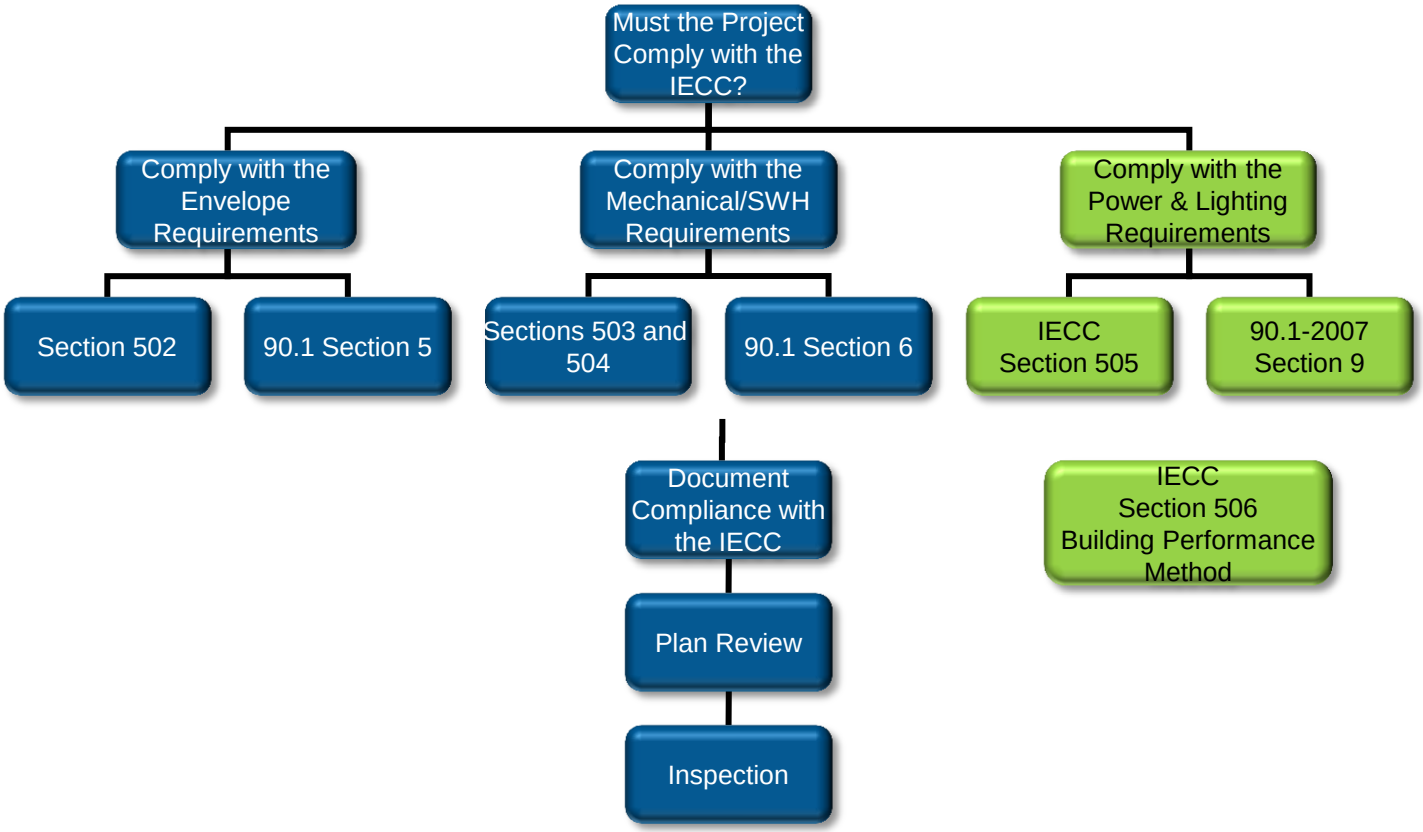
The IECC Code Compliance Process



Commercial Lighting Requirements in 2009 IECC

Commercial provisions contained in Chapter 5…with reference to ASHRAE 90.1-2007

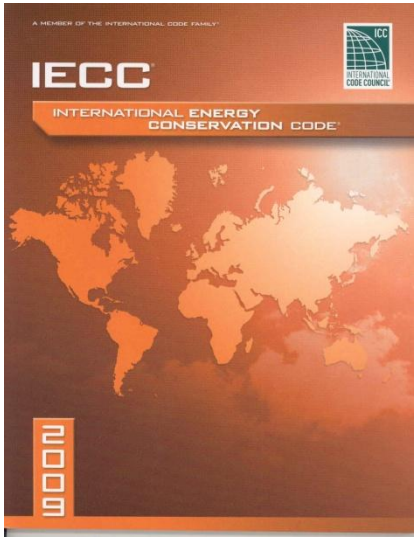
Covers lighting controls and power density for interior and exterior

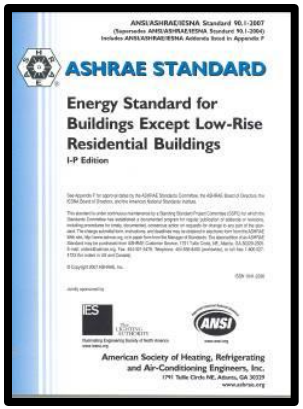
Exception: Lighting within dwelling units

Major changes in the 2009 version

Daylight zone control

New exterior lighting zones





When do the Lighting and Power Requirements Apply?

- Original Installed Lighting System in a New Building, Addition, or Tenant Build-out
- Existing Lighting System that is Altered
- Change in Occupancy that Increases Energy

High-Efficacy Lamps

Defined in the 2009 IECC as:

Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, or lamps with a minimum efficacy based on lamp wattage

Lamp Wattage	Efficacy
> 40 watts	60 lumens/watt
15-40 watts	50 lumens/watt
< 15 watts	40 lumens/watt

What's Covered Under Electrical Power and Lighting Systems Requirements?

- Mandatory Interior Lighting requirements
- Required Controls
- Wattage/Efficiency Limits
- Interior Lighting Power Allowances (watts/ft^2)

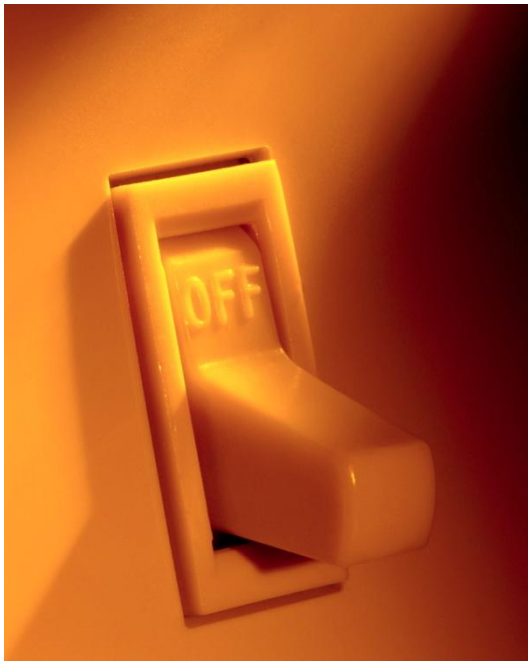
Interior Lighting Control (505.2): Basic Control

Independent Lighting Control required for each space surrounded by floor-to-ceiling partitions

- Must be located in the space served,

  - or -

- Switched from a remote location
- Must have indicator that identifies the lights served and their status (off or on)



Intent: Allow occupants to control unneeded lighting!

Interior Lighting Control: Light Reduction

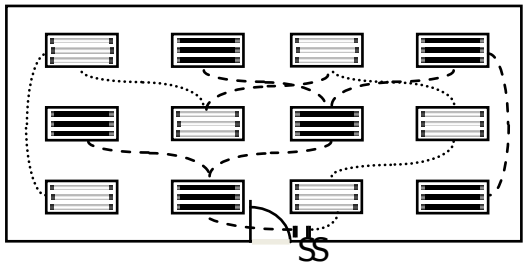
- Light Reduction Controls must allow the occupant to reduce connected lighting
- By at least 50%
- In a reasonably uniform illumination pattern
- Note: Alternate Standard ASHRAE/IESNA 90.1-2007 does not require Light Reduction Control

Intent: Allow occupants to moderate light levels to save energy!

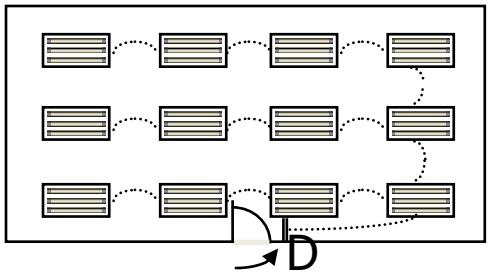
Light Reduction Control Options

- Controlling all lamps or luminaires
- Dual switching of alternate rows of luminaires, alternate luminaires or lamps
- Switching middle lamp luminaires independently from the outer lamps
- Each luminaire or each lamp

Alternating Luminaries

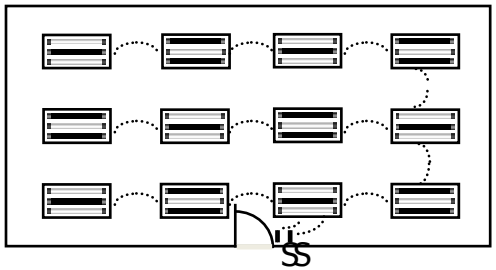


Dimming



Dimmer Switch

Alternating lamps



Interior Lighting Control: Light Reduction Exemptions

Light Reduction Control **Not** required for the following:

- Areas with only one luminaire
- Areas controlled by occupancy sensor
- Corridors, storerooms, restrooms or public lobbies
- Sleeping units
- Spaces with <0.6 w/ft^2

Interior Lighting Control: Automatic Shutoff

Automatic lighting shutoff control device required in all buildings larger than 5,000 ft^2

Building Defined:

- "Any structure used or intended for supporting or sheltering any use or occupancy"
- Building area surrounded by exterior walls and fire walls

Exempted spaces

- Sleeping units
- Lighting for patient care
- When an automatic shutoff would endanger occupant safety or security

Intent: Eliminate after hours lighting waste!

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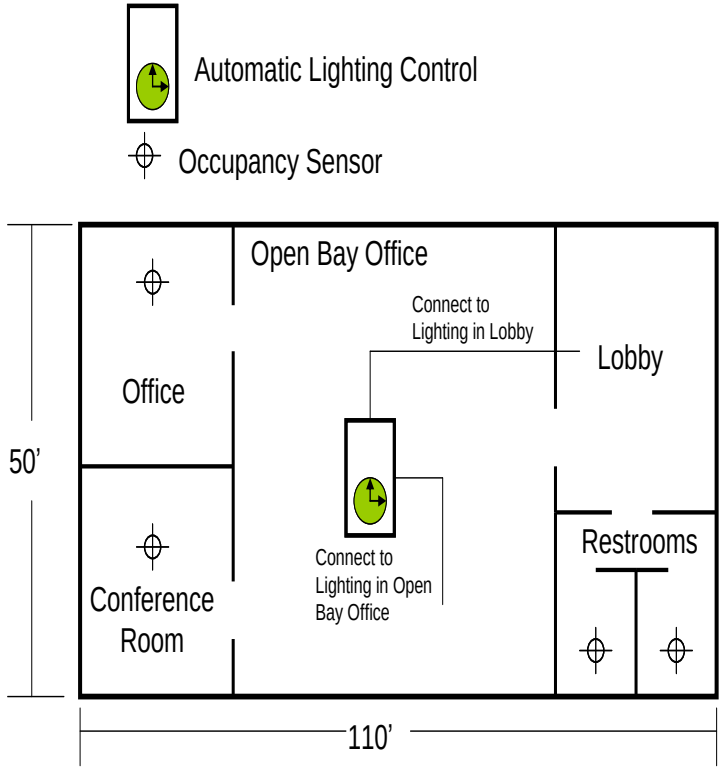
Interior Lighting Control: Automatic Shutoff Options

Automatic Lighting Shutoff Compliance Options:

1. Control lights on a scheduled basis (automatic time switch)
   - Time-of-day controller
   - Controls ≤ 25,000 ft^2 and not more than one floor, or
2. Occupant sensor
   - Turn lights off within 30 minutes of occupant leaving the space
3. Signal from another control or alarm that indicates the area is unoccupied



Courtesy Britt-Makela Group

Interior Lighting Control: Automatic Shutoff Override

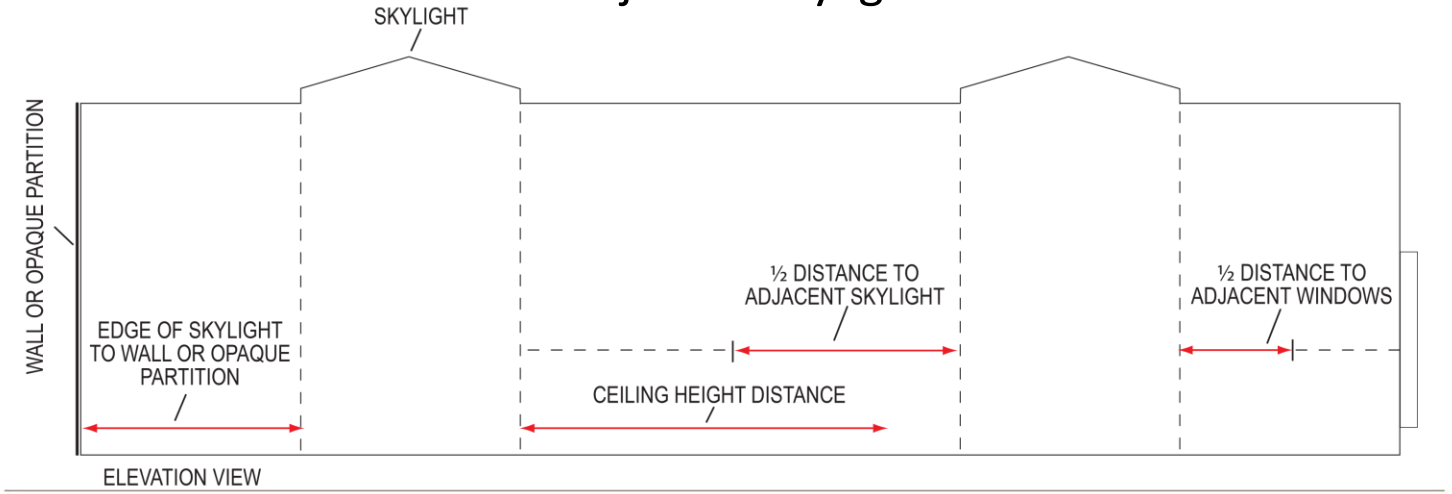
- Readily accessible
- Within view of the lights or area controlled
- Manually operated
- ≤ 2 hour override
- Controls an area ≤ 5,000 ft^2

Exemptions

- Can be over 2 hour override in malls and arcades, auditoriums, single-tenant retail space, industrial facilities and arenas when using captive key override
- Override in malls and arcades, auditoriums, single-tenant retail space, industrial facilities and arenas can cover up to 20,000 ft^2

Daylight Zone Definition –Under Skylights

- The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension plus the smaller of:
  - The floor-to-ceiling height, or
  - The distance to a ceiling height opaque partition, or
  - One-half the distance to adjacent skylights or windows



Daylight Zone Definition – Adjacent to Vertical Fenestration

- The daylight zone depth is assumed to be 15 feet into the space or to the nearest ceiling height opaque partition, whichever is less
- The daylight zone width is assumed to be:
  - the width of the window plus 2 feet on each side, **or**
  - the window width plus distance to opaque partitions, **or**
  - the window width plus one-half the distance to adjacent skylight or vertical fenestration, whichever is least.

Daylight Zone Control

Daylight zones

- Must have individual control of the lights independent of general area lighting
- Contiguous daylight zones adjacent to vertical fenestration
- Can be controlled by a single controlling device if the zone doesn't include areas facing more than two adjacent cardinal orientations (i.e., north, east, south, west)
- Daylight zones under skylights > 15 ft from the perimeter must be controlled separately from daylight zones adjacent to vertical fenestration

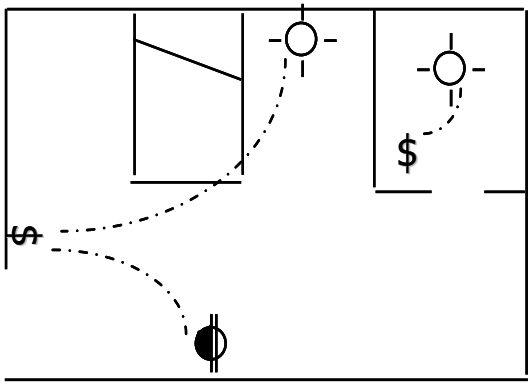
Daylight Zone Control

Exception

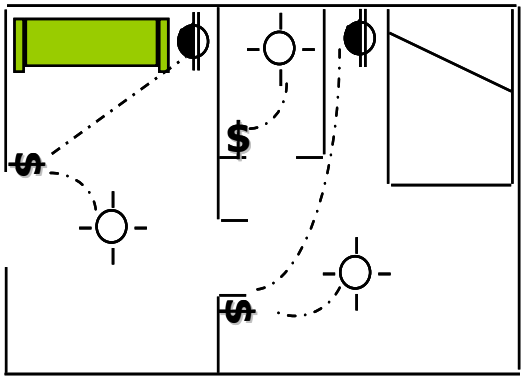
- Daylight spaces 1) enclosed by walls or ceiling height partitions and 2) containing two or fewer light fixtures
- not required to have a separate switch for general area lighting
- Note: required controls may be manual or automatic

Interior Lighting Control: Sleeping Unit Lighting Control

- Applies to hotels, motels, boarding houses, or similar
- Master switch required at each room or main room entry
- Must control all permanently wired luminaries or switched receptacles
- Exceptions: bathrooms



Standard Room

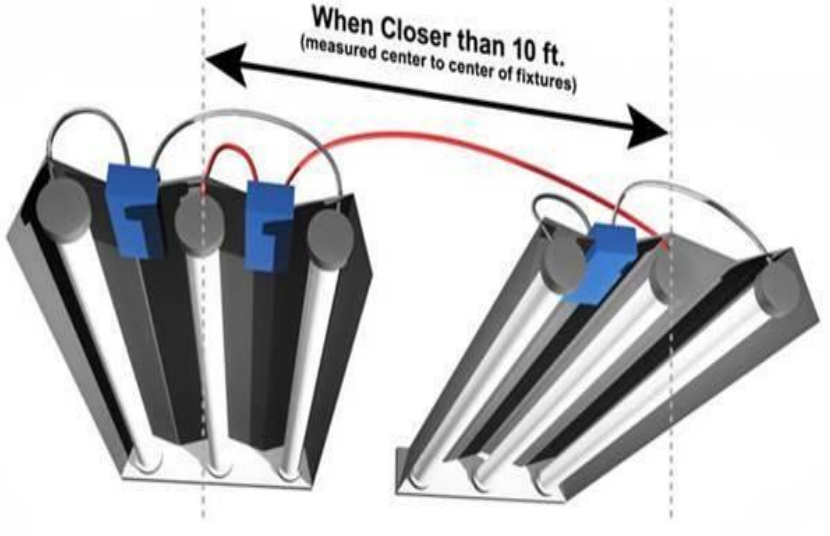


Suite

Intent: Allow occupant to turn off lights at exit point!

Tandem Wiring (505.3)

- Tandem Wiring for all Odd Numbered Lamp Configurations
- Exceptions:
- Where electronic high frequency ballasts are used
- Luminaries on emergency circuits
- Luminaries with no available pair in the same area



Intent: Eliminate the use of magnetic ballasts driving single lamps!

Exit Signs (505.4)

Exit Signs

Internally illuminated exit signs shall not exceed 5 watts per side

Interior Lighting Power Limits (505.5)

Connected Interior Lighting Power must not exceed Interior Lighting Power Allowance

1. Calculate Interior Lighting Power Allowance

Building Area type allowance
Additional allowances

2. Calculate proposed connected lighting power

Wattage calculation “rules”
Exempted lighting

3. Compare values: proposed wattage must be less than or equal to allowed wattage

Intent: Eliminate waste from sloppy lighting design and application!

Interior Lighting Power Allowances

Building Area Type
Note: Alternate Standard ASHRAE/IESNA 90.1-2007 provides whole building and space-by-space options

Table 505.5.2

LIGHTING POWER DENSITY	
Building Area Type[a]	**(W/ft²)**
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Healthcare—clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theater	1.2
Multifamily	0.7
Museum	1.1
Office	1.0
Parking Garage	0.3
Penitentiary	1.0
Performing Arts Theater	1.6
Police/Fire Station	1.0
Post Office	1.1
Religious Building	1.3
Retail[b]	1.5
School/University	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

Interior Lighting Power Allowance Calculation

First, choose an appropriate "Building Area Type" from the allowance table (505.5.2).

- "Building Area" includes all spaces that are associated with that business or function type. For example a space with:
- Corridors,
- Restrooms,
- A lobby, and
- Office space

…would be considered an Office Building Area Type

Then...multiply the lighting power density (W/ft^2) by the building square footage to get allowed watts for compliance

Office - Example

A 200,000 ft^2 office building that contains corridor, restrooms, break rooms and a lobby is given 1.0 W/ft^2 for the entire building

Office: 200,000 ft^2

1.0 W/ft^2 =

200,000 W

LIGHTING POWER DENSITY	
Building Area Type[a]	**(W/ft²)**
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Healthcare – clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theater	1.2
Multifamily	0.7
Museum	1.1
Office	1.0
Parking Garage	0.3
Penitentiary	1.0
Performing Arts Theater	1.6
Police/Fire Station	1.0
Post Office	1.1
Religious Building	1.3
Retail[b]	1.5
School/University	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

Interior Lighting Power Allowance for Multiple Occupancy Building

How is an allowance determined if the building has more than one Building Area Type?

Example – A building contains the following area types

Museum: 40,000 ft^2

Retail: 5,000 ft^2

Cafeteria: 10,000 ft^2

Use the more specific building area type where more than one area type exists in the building

Sum the individual (lighting power density X area square footage) values for Total Power Allowance

Multiple Occupancy Building - Example

Museum: 40,000 ft^2

at 1.1 W/ft^2 = 44,000 W

Cafeteria:10,000 ft^2

at 1.4 W/ft^2 = 14,000 W

Retail: 5,000 ft^2

at 1.5 W/ft^2 = 7,500 W

Total watts allowed = 65,500 W

LIGHTING POWER DENSITY

Building Area Type[a]	(W/ft^2)
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Healthcare – clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theater	1.2
Multifamily	0.7
Museum	1.1
Office	1.0
Parking Garage	0.3
Penitentiary	1.0
Performing Arts Theater	1.6
Police/Fire Station	1.0
Post Office	1.1
Religious Building	1.3
Retail[b]	1.5
School/University	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

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Additional Retail Lighting Power Allowance (Table 505.5.2 – Footnotes)

Additional Interior Lighting Power Allowance = 1000 watts + (Retail Area 1 x 0.6 W/ft2) + (Retail Area 2 x 0.6 W/ft2) +(Retail Area 3 x 1.4 W/ft2) + (Retail Area 4 x 2.5 W/ft2),

Where:

Retail Area 1 = the floor area for all products not listed in Retail Area 2, 3 or 4.

Retail Area 2 = the floor area used for the sale of vehicles, sporting goods and small electronics.

Retail Area 3 = the floor area used for the sale of furniture, clothing, cosmetics and artwork.

Retail Area 4 = the floor area used for the sale of jewelry, crystal, and china.

Intent: Allow flexibility in design for critical retail applications!

Proposed Lighting Power Calculation

Sum the wattage of all proposed connected lighting power

This must include all lighting that is part of the design for the space including:

- Overhead lighting
- Task lighting
- Decorative lighting

Note: Wattage must be calculated based on actual power draw…not just nominal lamp rating

Proposed Lighting Calculation: Rules

Lighting wattage must be documented in accordance with Section 505.5.1

Screw lamp holders: maximum labeled wattage of the luminary

Low voltage lighting: transformer wattage

Line voltage track:

1. specified wattage with minimum of 30 W/linear ft **OR**
2. wattage limit of system's circuit breaker **OR**
3. wattage limit of other permanent current limiting devices

Other: manufacturer's rated wattage of lamp and associated ballast

Exemptions to Proposed Lighting Power Calculation

- Connected power for following not included in calculations:
  - Professional sports arena playing field
  - Sleeping unit lighting
  - Emergency lighting automatically off during normal building operation
  - Lighting in spaces specifically designed for use by occupants with special lighting needs including visual impairment and other medical and age related issues
  - Lighting in interior spaces specifically designated as a registered interior historic landmark
  - Casino gaming areas
- Lighting equipment used for the following exempt if in addition to general lighting and controlled by an independent control device
  - Task lighting for medical and dental procedures
  - Display lighting for exhibits in galleries, museums and monuments

What if My Proposed Design Does Not Meet Code?

- Check calculations and design
- Appropriate area type allowances used?
- Actual lighting equipment wattages used?

  …and design
- Reasonable illuminance levels provided?
- Efficient light sources used?
- Use alternate Standard 90.1-2007*
- Use total Building Performance Method

*Section 501.2 Application requires 90.1 to be used in its entirety (Envelope, Lighting, Mechanical) if used as an alternate compliance path

Exterior Lighting Control Requirements (505.2.4)

- For dusk-to-dawn lighting: astronomical time switch or photosensor
- For all other: astronomical time switch OR photosensor + time switch
- All time switches must have 10 hour battery backup

Exterior Efficiency Requirement (505.6.1)

Building grounds lighting luminaires over 100 watts must have source efficacy of at least 60 lumens per watt

Light Source	Typical System Efficacy Range in LPW (varies depending on wattage and lamp type)
Incandescent	10-18
Halogen incandescent	15-20
Compact fluorescent (CFL)	35-60
Linear fluorescent	50-100
Metal halide	50-90

Exterior Lighting Power Limits (505.6.2)

Connected Exterior Lighting Power must not exceed Exterior Lighting Power Allowance

- Calculate exterior Lighting Power Allowance
  - Lighting power densities by exterior function and by applicable lighting zone
- Calculate proposed connected lighting power
  - Wattage calculation “rules”
  - Exempted lighting
- Compare values: proposed wattage must be less than or equal to allowed wattage

Exterior Lighting Power Limits (505.6.2)

What areas are covered under exterior lighting allowances?

- **Tradable surfaces**

Common exterior lighted needs that can be traded for other needs.
For example, wattage allowed for parking lot lighting can be “traded” and used for canopy lighting.

- **Nontradable surfaces**

Less common exterior lighted needs that **cannot** be traded for other needs. These applications have more specific security or task illuminance needs.

Tradable Surfaces

- Uncovered parking lots and areas
- Walkways (under and over 10 feet wide)
- Stairways
- Pedestrian tunnels
- Main building entrances
- Other doors

Nontradable Surfaces

- Building facades
- Automated teller machines and night depositories
- Entrances and gatehouse inspection stations at guarded facilities
- Loading areas for law enforcement, fire, ambulance and other emergency vehicles

Exterior Lighting Zones [Table 505.6.2(1)]

Lighting Zone	Description
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

Exterior Lighting Zones

		Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance		500 W	600 W	750 W	1300 W
Tradable Surfaces	**Uncovered Parking Areas**				
	Parking areas and drives	0.04 W/ft^2	0.06 W/ft^2	0.10 W/ft^2	0.13 W/ft^2
	Building Grounds				
	Walkways less than 10 feet wide	0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot
	Walkways 10 feet wide or greater Plaza areas Special Feature Areas	0.14 W/ft^2	0.14 W/ft^2	0.16 W/ft^2	0.2 W/ft^2
	Stairways	0.75 W/ft^2	1.0 W/ft^2	1.0 W/ft^2	1.0 W/ft^2
	Pedestrian Tunnels	0.15 W/ft^2	0.15 W/ft^2	0.2 W/ft^2	0.3 W/ft^2

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Exterior Lighting Zones con't

		Zone 1	Zone 2	Zone 3	Zone 4
Tradable Surfaces	**Building Entrances and Exits**				
	Main entries	20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	30 W/linear foot of door width
	Other doors	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
	Entry Canopies	0.25 W/ft^2	0.25 W/ft^2	0.4 W/ft^2	0.4 W/ft^2
	Sales Canopies				
	Free-standing and attached	0.6 W/ft^2	0.6 W/ft^2	0.8 W/ft^2	1.0 W/ft^2
	Outdoor Sales				
	Open areas (including vehicle sales lots)	0.25 W/ft^2	0.25 W/ft^2	0.5 W/ft^2	0.7 W/ft^2
	Street frontage for vehicle sales lots in addition to "open area" allowance	No allowance	10 W/linear foot	10 W/linear foot	30 W/linear foot

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Non-Tradable Surfaces	**Building Facades**	No allowance	0.1 W/ft^2 for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length	0.15 W/ft^2 for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length	0.2 W/ft^2 for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length
	Automated teller machines and night depositories	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location
	Entrances and gatehouse inspection stations at guarded fac.	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area
	Loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area
	Drive-up windows/doors	400 W per drive-through	400 W per drive-through	400 W per drive-through	400 W per drive-through
	Parking near 24-hour retail entrances	800 W per main entry	800 W per main entry	800 W per main entry	800 W per main entry

Exemptions from Exterior Calculation (505.6.2)

- The following lighting does not need to be included in the proposed lighting calculation:
- Specialized signal, directional, and marker lighting associated with transportation
- Advertising signage or directional signage
- Lighting integral to *equipment* or instrumentation and installed by its *manufacturer*
- Lighting for theatrical purposes, including performance, stage, film production, and video production

What if My Proposed Exterior Lighting Does Not Meet Code?

- Check calculations and design
- Appropriate surface allowances used?
- Actual lighting equipment wattages used?

  …and design
- Reasonable illuminance levels provided?
- Efficient light sources used?
- Use alternate Standard 90.1-2007*
- Use total Building Performance Method

*Section 501.2 Application requires 90.1 to be used in its entirety (Envelope, Lighting, Mechanical) if used as an alternate compliance path

Electrical Energy Consumption Mandatory Requirement (505.7)

Separate metering required for each dwelling unit

Intent: Occupant understanding of actual energy use can promote effective energy use!

Promoting Awareness of 2009 IECC

General Resources

Top 10 Reasons for Building Energy Codes, U.S. Dept. of Energy

Frequently-Asked Questions, U.S. Dept. of Energy

Topic 3

Commercial Resources, Building Data Collection Checklist and COMcheck

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Building data collection checklists

- To “check on” compliance, the first step is to have a proper checklist. BECP offers evaluation checklists for both residential and commercial buildings, complete with instructions to help evaluators.

- The checklists offer weighted scoring in order to focus on the most important code requirements and help states produce accurate metrics.

BECP Tool:
Download inspection checklists and corresponding instructions at:
www.energycodes.gov/arra/compliance_evaluation.stm

Building data collection checklists

1. Commercial Building Data Collection Checklist
ANSI/ASHRAE/IESNA Standard 90.1-2007

2. Commercial Building Data Collection Checklist 2009 International Energy Conservation Code

Software

No-cost, easy-to-use software that will demonstrate compliance

COMcheck™

Software

No-cost, easy-to-use software that will demonstrate compliance.
www.energycodes.gov/software.stm

Desktop Software Tools

Web-Based Tools

Free

COMcheck™

Windows version or
Mac version

COMcheck•Web™

COMcheck™ Package Generator

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Commercial Compliance

Building System

- Envelope
- Lighting
- Mechanical
  - HVAC
  - SWH

Mandatory Provisions

(required for most compliance options)

Compliance Options

- Prescriptive Option
- Trade Off Option
- Total Building Performance

Energy Code Compliance

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Info You'll Need

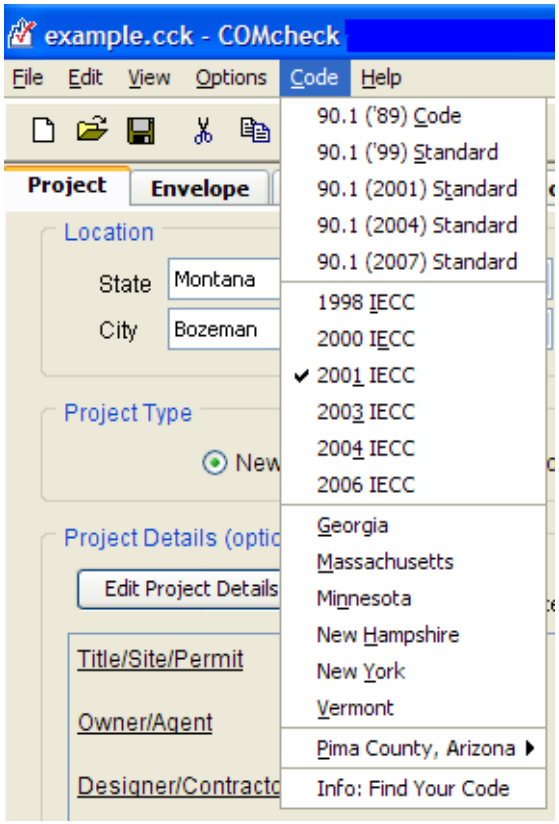
- Basic information about the builder and project
- Area take-offs for exterior walls, fenestration, roof/ceiling, basement walls, floors, etc.
- Insulation R-values, fenestration U-factors, etc.
- Lighting fixture details
- Heating and cooling system details
- Service water heating details

Main Steps

- Select the Appropriate Code
- Enter Project Information
- Enter Building Components
- Enter Interior/Exterior Lighting
- Enter Mechanical Equipment
- View/Print the Compliance Report(s)
- Save the Data File and the Report

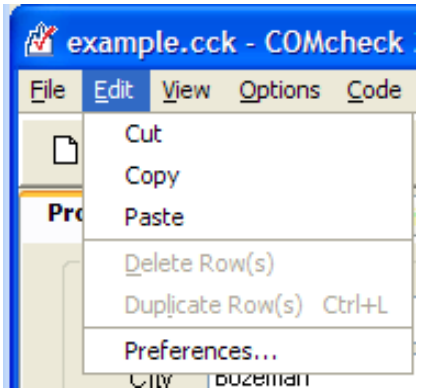
Appropriate Code

- Energy code applicable to your state/ jurisdiction (Code Menu)
- Status of State Codes
- Default
- Preferences



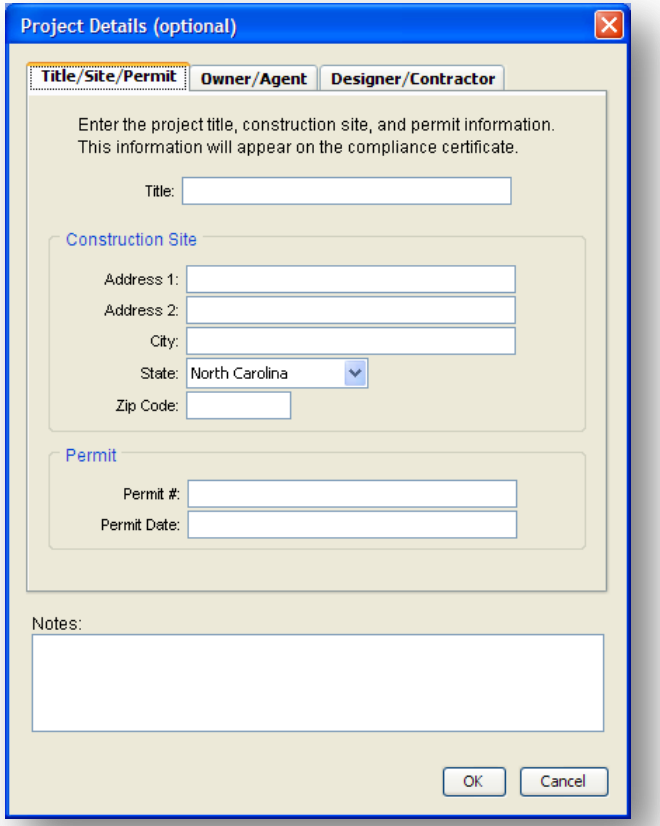
Navigation Bar

- Edit Menu
- General
- File Options
- Beyond Code Advisor
- Version Update Check
- Project
- Code/location
- Envelope
- Applicant
  - Project Details
- Reports
  - Signatures
  - Email Reports

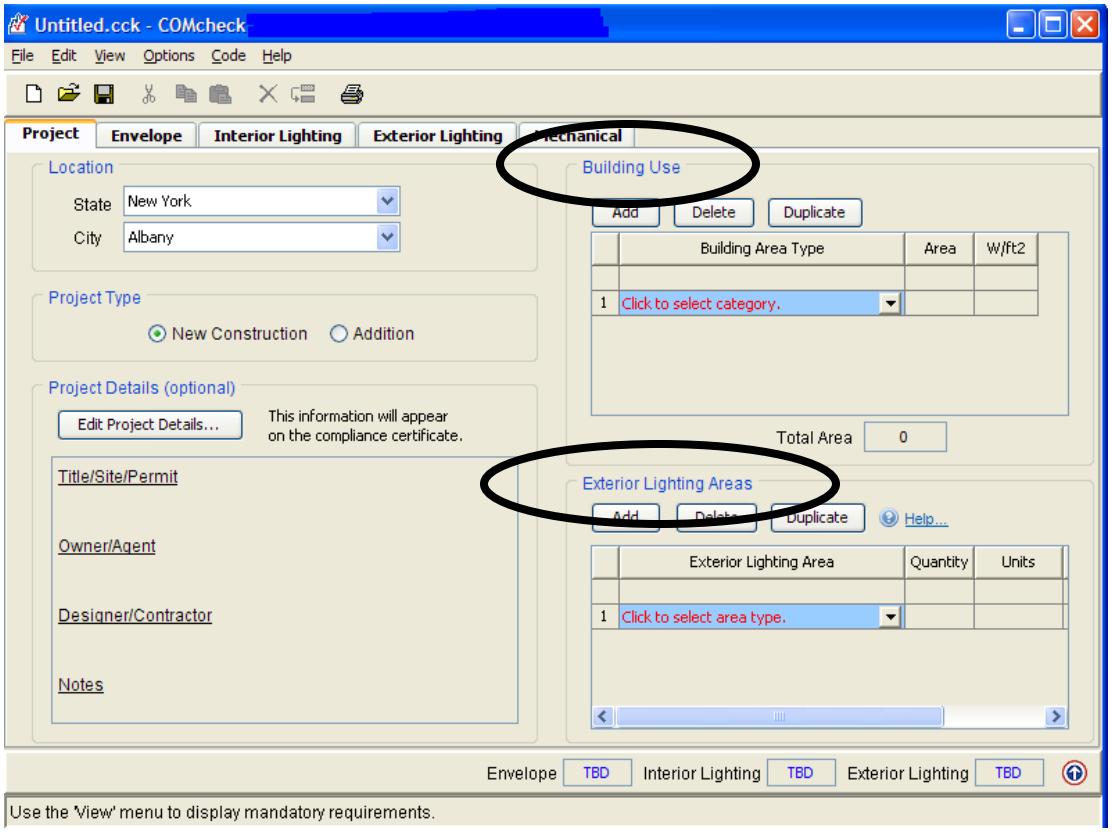


Project Information

- Project location
- Project type
- Project details for report (optional)
- Title/Site/Permit
- Owner/Agent
- Designer/Contractor
- Notes



Project Screen



Building Use Types

- Vary by code
- Internal loads
- Lighting power allowances

Building Components

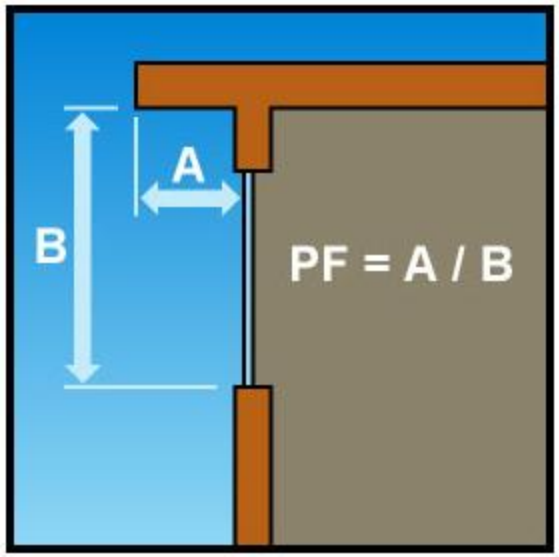
- Only components that separate conditioned space from unconditioned space/outside air
- Only use applicable buttons
- Can group “like” components
- Use of “other” assembly type
- Gross area

Foundations

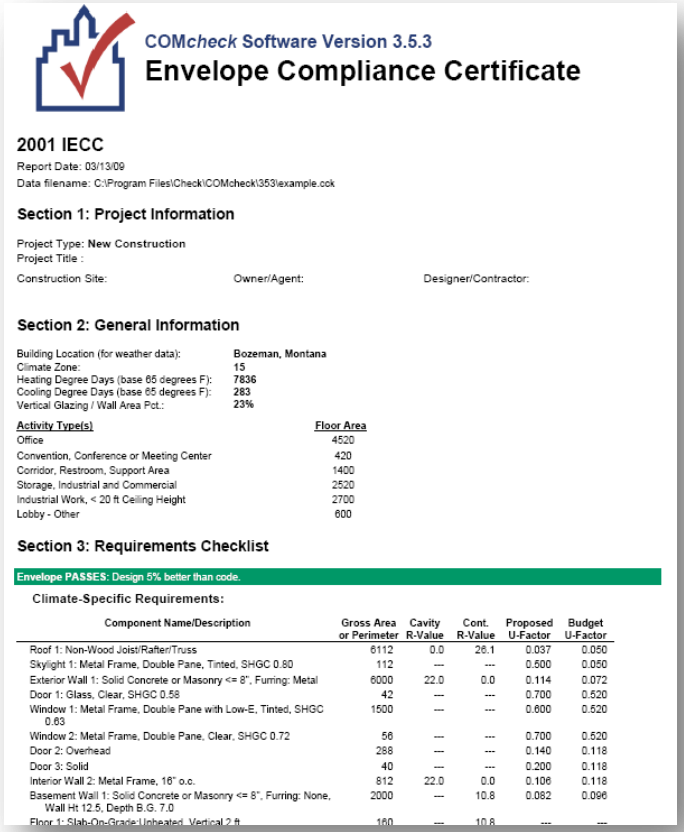
- Basement button – use if
  - basement is conditioned
  - basement walls are insulated
- Floor button – use if
  - separates conditioned from unconditioned space (includes slab-on-grade floor)

Envelope Screen

- Entries can change based on code and/or location selected
- Assembly types
- *Int. Wall* button
- Projection Factor
- Orientation



Envelope Results



COMcheck Software Version 3.5.3

Envelope Compliance Certificate

2001 IECC

Report Date: 03/13/09
Data filename: C:\Program Files\Check\COMcheck\353\example.cck

Section 1: Project Information

Project Type: **New Construction**
Project Title :

Construction Site: Owner/Agent: Designer/Contractor:

Section 2: General Information

Building Location (for weather data):	**Bozeman, Montana**
Climate Zone:	**15**
Heating Degree Days (base 65 degrees F):	**7836**
Cooling Degree Days (base 65 degrees F):	**283**
Vertical Glazing / Wall Area Pct.:	**23%**

Activity Type(s)	Floor Area
Office	4520
Convention, Conference or Meeting Center	420
Corridor, Restroom, Support Area	1400
Storage, Industrial and Commercial	2520
Industrial Work, < 20 ft Ceiling Height	2700
Lobby - Other	600

Section 3: Requirements Checklist

Envelope PASSES: Design 5% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Roof 1: Non-Wood Joist/Rafter/Truss	6112	0.0	26.1	0.037	0.050
Skylight 1: Metal Frame, Double Pane, Tinted, SHGC 0.80	112	---	---	0.600	0.050
Exterior Wall 1: Solid Concrete or Masonry <= 8", Furring: Metal	6000	22.0	0.0	0.114	0.072
Door 1: Glass, Clear, SHGC 0.58	42	---	---	0.700	0.620
Window 1: Metal Frame, Double Pane with Low-E, Tinted, SHGC 0.63	1500	---	---	0.600	0.620
Window 2: Metal Frame, Double Pane, Clear, SHGC 0.72	56	---	---	0.700	0.620
Door 2: Overhead	288	---	---	0.140	0.118
Door 3: Solid	40	---	---	0.200	0.118
Interior Wall 2: Metal Frame, 16" o.c.	612	22.0	0.0	0.106	0.118
Basement Wall 1: Solid Concrete or Masonry <= 8", Furring: None, Wall Ht 12.5, Depth B.G. 7.0	2000	---	10.8	0.082	0.096
Floor 1: Slab-On-Grade:Unheated, Vertical 2 ft	160	---	10.8	---	---

Interior Lighting

- Mandatory requirements
- Interior lighting power requirements
- Complies if total connected power is less than interior lighting power allowance (entire building or partial building)

Proposed Wattage	$\leq$	Allowed Wattage

Interior Lighting

- LPDs based on Building Use on *Project* screen
- Add fixtures
- Identify exemptions and allowances (if applicable)

	Component	Fixture ID	Fixture Description	Lamp Description/ Wattage Per Lamp	Ballast	Lamps Per Fixture	Number of Fixtures	Fixture Wattage
	Building	Allowed wattage = 17320 Proposed wattage = 12478						
1	Office (4520 sq.ft.)	Allowed wattage = 6780 Proposed wattage = 1976						
2	Incandescent 1	G	Recessed wall washer	Incandescent 150W		1	2	150
3	Incandescent 2	H	Accent track lighting	Incandescent 50W		1	5	50
4	Compact Fluorescent 1	F	Down light, twin tube	Twin Tube 18W	Magnetic	2	31	46
5	Convention, Conference or M	Allowed wattage = 630 Proposed wattage = 3900						
6	T8 / T12 Fluorescent 5	E	8 ft. Industrial, penda...	96" T8 75W	Electronic	2	30	130

Exemptions and Allowances

Options menu

Based on code selected

Exemptions

- Power for exempt fixtures is omitted from the **proposed wattage**

Allowances

- **Allowed wattage** for building increased by allowable amount

Interior Lighting Results

COMcheck Software Version 3.6.0

Interior Lighting Compliance Certificate

2006 IECC

Section 1: Project Information

Project Type: **New Construction**
Project Title :
Construction Site: Owner/Agent: Designer/Contractor:

Section 2: General Information

Building Use Description by: **Activity Type**

Activity Type(s)	Floor Area
Office	4520
Convention Center	420
Warehouse	2520

Section 3: Requirements Checklist

Interior Lighting:

☐ 1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
7040	6136	YES

Controls, Switching, and Wiring:

☐ 2. Independent controls for each space (switch/occupancy sensor).
Exceptions:
Areas designated as security or emergency areas that must be continuously illuminated.
Lighting in stairways or corridors that are elements of the means of egress.
☐ 3. Master switch at entry to hotel/motel guest room.
☐ 4. Individual dwelling units separately metered.
☐ 5. Each space provided with a manual control to provide uniform light reduction by at least 50%.
Exceptions:
Only one luminaire in space;
An occupant-sensing device controls the area;
The area is a corridor, storeroom, restroom, public lobby or sleeping unit.
Areas that use less than 0.6 Watts/sq.ft.
☐ 6. Automatic lighting shutoff control in buildings larger than 5,000 sq.ft.
Exceptions:
Sleeping units, patient care areas; and spaces where automatic shutoff would endanger safety or security.
☐ 7. Photocell/astronomical time switch on exterior lights.
Exceptions:
Lighting intended for 24 hour use.
☐ 8. Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).
Exceptions:
Electronic high-frequency ballasts; Luminaires on emergency circuits or with no available pair.

Section 4: Compliance Statement

COMcheck Software Version 3.6.0

Interior Lighting Application Worksheet

2006 IECC

Section 1: Allowed Lighting Power Calculation

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B x C)
Office	4520	1	4520
Convention Center	420	1.2	504
Warehouse	2520	0.8	2016
		Total Allowed Watts =	7040

Section 2: Proposed Lighting Power Calculation

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Office (4520 sq.ft.)				
Incandescent 1: G: Recessed wall washer / Incandescent 150W	1	2	150	300
Incandescent 2: H: Accent track lighting / Incandescent 50W	1	5	50	250
Compact Fluorescent 1: F: Down light, twin tube / Twin Tube 18W / Magnetic	2	31	46	1426
Convention Center (420 sq.ft.)				
T8 / T12 Fluorescent 5: E: 8 ft. Industrial, pendant mount / 96" T8 75W / Electronic	2	30	130	3900
Warehouse (2520 sq.ft.)				
T8 / T12 Fluorescent 3: C: 4 ft. Wall mout, wrap-around / 48" T8 32W / Electronic	2	4	65	260
			Total Proposed Watts =	6136

Section 3: Compliance Calculation

If the Total Allowed Watts minus the Total Proposed Watts is greater than or equal to zero, the building complies.

Total Allowed Watts =	7040
Total Proposed Watts =	6136
Project Compliance =	904

Interior Lighting PASSES: Design 13% better than code.

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Exterior Lighting

- Based on code selected
- Mandatory requirements
- Exemptions

Total Connected Power	<	Ext. Ltg. Power Allowance

Exterior Lighting

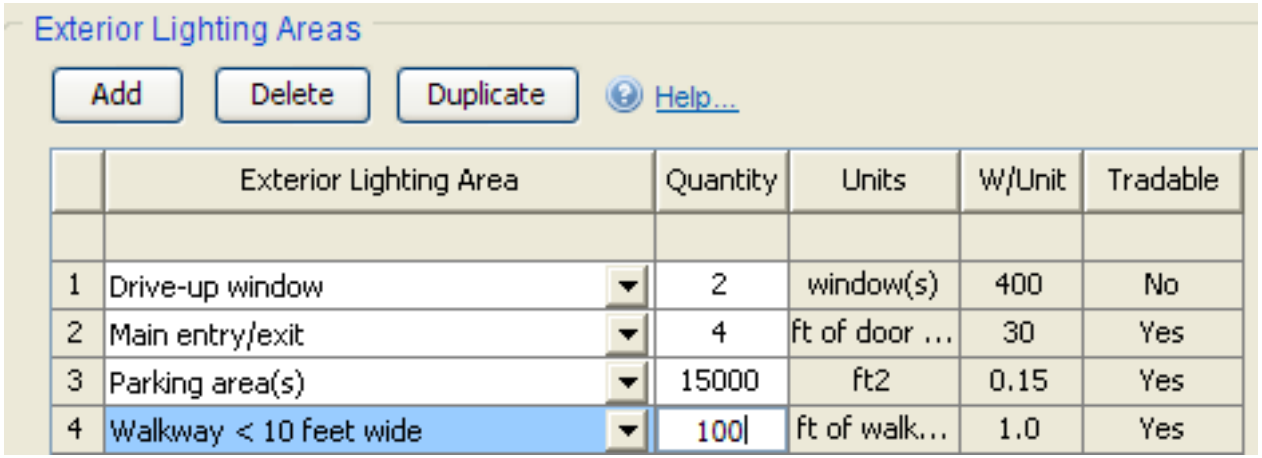
- Pay attention to Quantity and Units

Tradable

- Common applications where unused power can be traded where needed

Non-Tradable

- Less common applications that cannot be traded



Exterior Lighting Results

COMcheck Software Version 3.5.3

Exterior Lighting Compliance Certificate

2006 IECC

Report Date: 03/12/09

Data filename: C:\Program Files\Check\COMcheck\353\example.cck

Section 1: Project Information

Project Type: **New Construction**

Project Title :

Construction Site: Owner/Agent: Designer/Contractor:

Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (C x D)	F Proposed Watts
Drive-up window	2 window(s)	400	No	800	960
Main entry/exit	4 ft of door width	30	Yes	120	84
Parking area(s)	15000 ft2	0.15	Yes	2250	2200
Walkway < 10 feet wide	100 ft of walkway length	1	Yes	100	99
			Total Tradable Watts* =	2470	2383
			Total Allowed Watts =	3270	
			Total Allowed Supplemental Watts** =	164	

* Wattage tradeoffs are only allowed between tradable areas/surfaces.
** A supplemental allowance equal to 5% of total allowed wattage may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Drive-up window (2 window(s)): Non-tradable Wattage				
HID 1: Metal Halide 100W / Magnetic	1	8	120	960
Main entry/exit (4 ft of door width): Tradable Wattage				
Compact Fluorescent 1: Spiral 42W / Electronic	1	2	42	84
Parking area(s) (15000 ft2): Tradable Wattage				
HID 2: Metal Halide 100W / Magnetic	1	5	440	2200
Walkway < 10 feet wide (100 ft of walkway length): Tradable Wattage				
HID 3: Metal Halide 32W / Electronic	1	3	33	99
			Total Tradable Proposed Watts =	2383

Section 4: Requirements Checklist

Lighting Wattage:

☐ 1. Within each non-tradable area/surface, total proposed watts must be less than or equal to total allowed watts. Across all tradable areas/surfaces, total proposed watts must be less than or equal to total allowed watts.
Compliance: Passes using supplemental allowance watts.

Controls, Switching, and Wiring:

MISSOURI DEPARTMENT OF NATURAL RESOURCES

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Mechanical Equipment

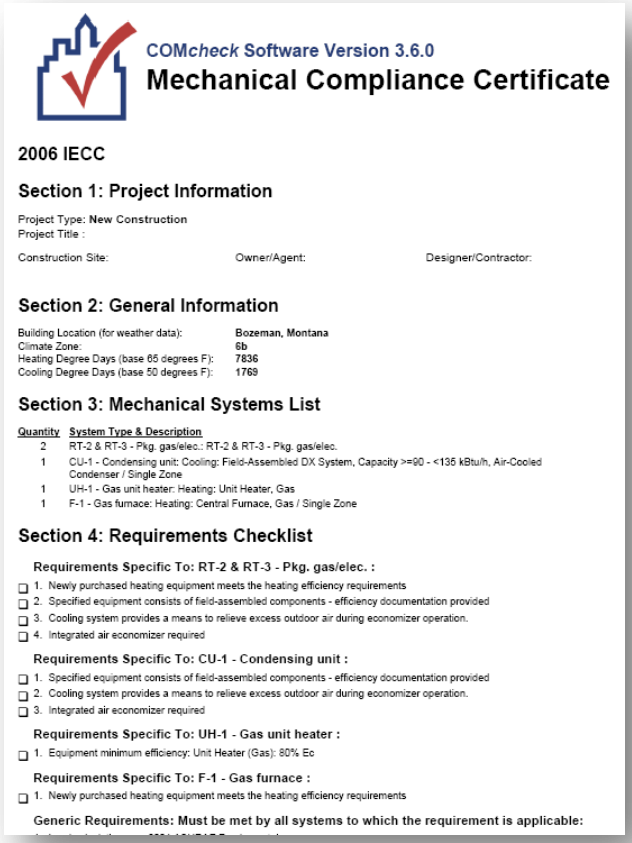
Works differently than Envelope and Lighting

Enter characteristics of:

- HVAC system
- Plant
- Water heating

Generates a customized list of requirements

Mechanical Report



COMcheck Software Version 3.6.0

Mechanical Compliance Certificate

2006 IECC

Section 1: Project Information

Project Type: **New Construction**
Project Title :

Construction Site: Owner/Agent: Designer/Contractor:

Section 2: General Information

Building Location (for weather data):	**Bozeman, Montana**
Climate Zone:	6b
Heating Degree Days (base 65 degrees F):	7836
Cooling Degree Days (base 50 degrees F):	1769

Section 3: Mechanical Systems List

Quantity	System Type & Description
2	RT-2 & RT-3 - Pkg. gas/elec.: RT-2 & RT-3 - Pkg. gas/elec.
1	CU-1 - Condensing unit: Cooling: Field-Assembled DX System, Capacity >=90 - <135 kBtu/h, Air-Cooled Condenser / Single Zone
1	UH-1 - Gas unit heater: Heating: Unit Heater, Gas
1	F-1 - Gas furnace: Heating: Central Furnace, Gas / Single Zone

Section 4: Requirements Checklist

Requirements Specific To: RT-2 & RT-3 - Pkg. gas/elec. :

- ☐ 1. Newly purchased heating equipment meets the heating efficiency requirements
- ☐ 2. Specified equipment consists of field-assembled components - efficiency documentation provided
- ☐ 3. Cooling system provides a means to relieve excess outdoor air during economizer operation.
- ☐ 4. Integrated air economizer required

Requirements Specific To: CU-1 - Condensing unit :

- ☐ 1. Specified equipment consists of field-assembled components - efficiency documentation provided
- ☐ 2. Cooling system provides a means to relieve excess outdoor air during economizer operation.
- ☐ 3. Integrated air economizer required

Requirements Specific To: UH-1 - Gas unit heater :

- ☐ 1. Equipment minimum efficiency: Unit Heater (Gas): 80% Ec

Requirements Specific To: F-1 - Gas furnace :

- ☐ 1. Newly purchased heating equipment meets the heating efficiency requirements

Generic Requirements: Must be met by all systems to which the requirement is applicable:

Mandatory Requirements

- Must be met by all buildings
- Included in compliance report(s)
- Viewable in software Help

Help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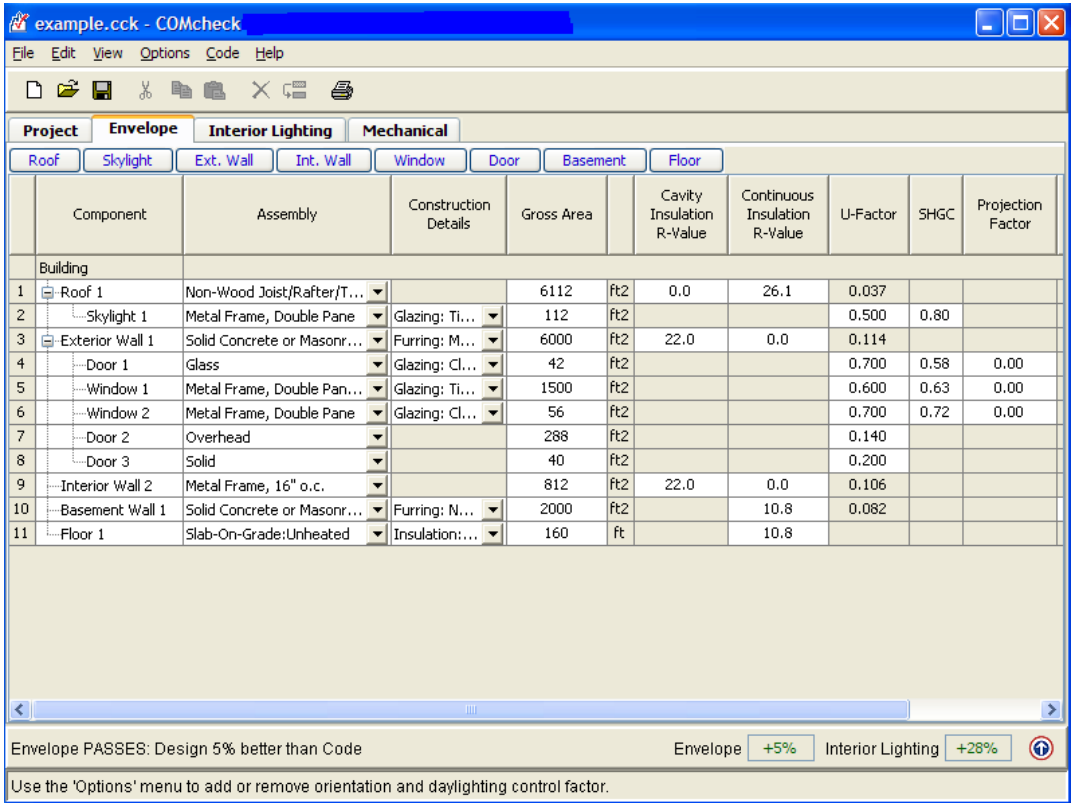
Screen Operations



Compliance Bar

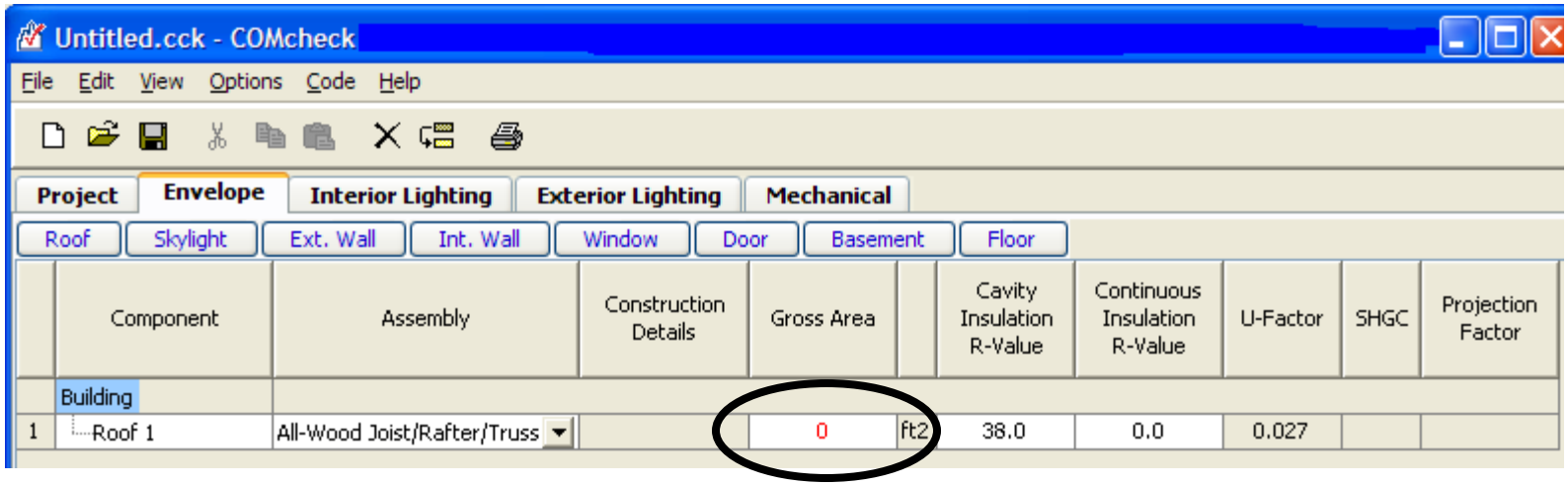
Status Bar

Screen Operations

Compliance Bar

Status Bar

Colors - Red



Screen Operations

Compliance Bar

Status Bar

Colors - Green

Screen Operations

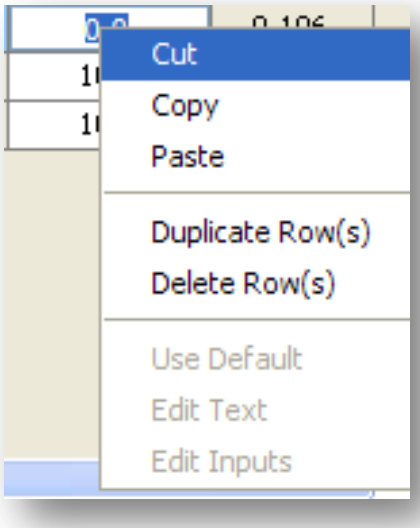
Compliance Bar

Status Bar

Colors - Blue

Screen Operations

Compliance Bar
Status Bar
Colors
Right Mouse Button
"Context" Menu



Files

Data (*File* ⇨ *Save*)
Report (*File* ⇨ *Save Report*)
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Additional COM*check* Training Opportunities

- COM*check* 101
- COM*check* 201
- Case studies

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